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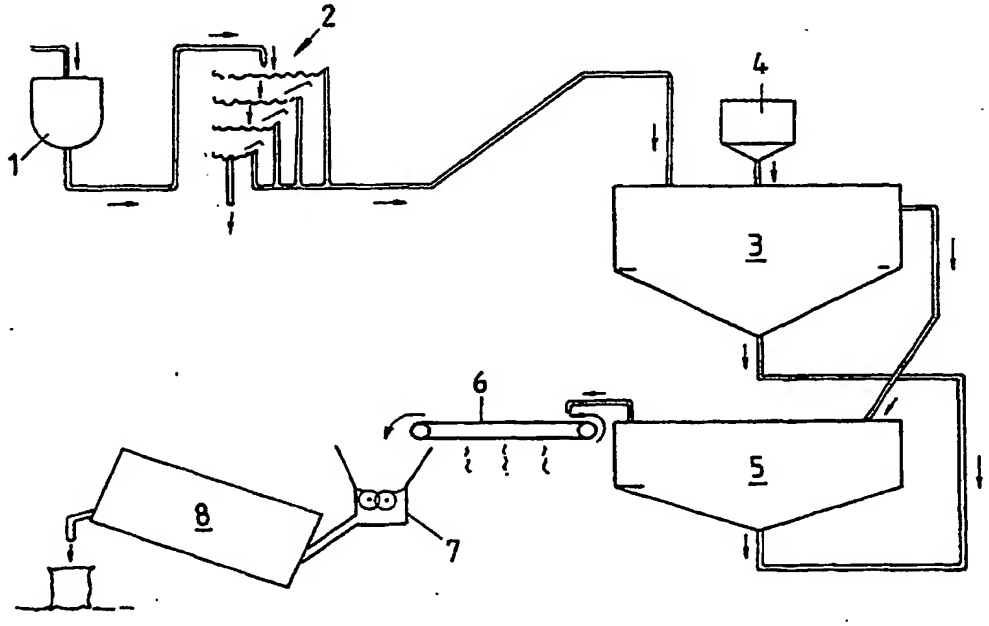

(57) Abstract

A method for the manufacture of a peat moss alternative comprises the steps of treating granules of tree or plant bark at an elevated temperature in an aqueous alkaline medium to kill heat labile plant pathogens and to partially dissolve lignins in the bark. The treated bark is immersed into cold water to separate exogenous portions of the bark granules. The endogenous portions are milled to provide a shredded fibrous product having a substantially neutral pH.

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TITLE

PEAT MOSS ALTERNATIVE

FIELD OF THE INVENTION

This invention is concerned with a method and apparatus for the manufacture of a peat moss alternative useful as a plant growth or culture medium.

BACKGROUND ART

While naturally occurring peat moss is generally satisfactory for use as a plant growth medium it suffers a number of disadvantages.

A major disadvantage is the harvesting of naturally occurring peat moss. Peat moss or sphagnum is associated with deposits of peat which in turn is a highly organic soil comprised of decomposed vegetable matter. Peat deposits are not widespread and thus substantial cost overheads are incurred in the collection, transportation and storage of peat mosses.

Being a naturally occurring product, it is generally not possible to culture peat moss as a renewable crop in a meaningful time frame. Moreover, natural peat moss contains a high abundance of naturally occurring bacteria, viruses, protozoa, insect and other parasites and, in particular, fungi.

As many of the micro-organisms and insect parasites associated with naturally occurring peat mosses are pathogenic to a wide variety of cultured plant species, it is desirable to sterilise peat moss or potting mixtures made therewith to ensure not only the health of plants but also the health of humans handling this material. For example, bacterial legionella infections in humans have been traced to potting mixes.

An effective way of sterilising peat moss (and thereby reducing transportation mass) is to allow the peat moss to dry in the sun. This process is slow and adds still further to the cost of the product. Once the peat moss has dehydrated, it is quite difficult and time

consuming to re-hydrate.

Yet another disadvantage of peat moss is that it is often contaminated with peat which can be acidic. Plant species intolerant to an acidic growth medium may be affected by peat moss growth media.

According to one aspect of the invention there is provided a method for the manufacture of a peat moss alternative, said method comprising the steps of:-

treating granules of tree or plant bark at an elevated temperature in the presence of an aqueous alkali solution to kill heat labile plant pathogens and to at least partially dissolve lignins contained in said bark;

immersing said bark granules while heated into water at ambient temperature to cause separation of exogenous and endogenous portions of said bark granules;

collecting said endogenous bark portions; and,

milling said endogenous bark portions to cause at least partial separation of the cellulosic fibres therein.

Suitably said granulated bark has a particle size in the range 5 mm to 50 mm.

Preferably the pH of said aqueous alkaline solution is chosen to produce an endogenous particulate bark material having a substantially neutral pH.

The aqueous alkaline solution suitably is selected from an expensive readily obtainable material such as sodium or potassium chloride or hypochlorite, quicklime, soda ash, powdered limestone, slaked lime, dolomite or mixtures thereof.

Preferably the alkaline solution comprises a mixture of powdered limestone and dolomite at least partially dissolved in water.

If required the alkaline solution may also include trace elements, plant nutrients, fungicides, pesticides and the like, either alone or in a preselected combination.

Heating of the bark may be achieved by any suitable means such as a hot air oven, steam oven, radiant

heaters or microwave radiation. Preferably heating is effected by heating the bark granules in a body of water at an elevated temperature at atmospheric or at elevated pressure in a pressure vessel.

The bark granules are suitably heated at a temperature in the range 50°C - 130°C, preferably at between 95°C - 105°C.

SUMMARY OF THE INVENTION

According to another aspect of the invention there is provided an apparatus for the manufacture of a peat moss alternative, said apparatus comprising:-

a heat treatment vessel including means to heat a body of liquid contained in the vessel;

conveyor means adapted to move bark particles through said heat treatment vessel at a predetermined rate;

a separation vessel containing, in use, a body of unheated water;

transfer means to transfer treated particulate bark from said heat treatment vessel to said separation vessel;

collection means to collect particles of treated exogenous bark from said separation vessel;

collection means to collect particles of treated endogenous bark from said separation vessel; and,

milling means adapted to shred particles of treated endogenous bark collected from said separation vessel to produce a fibrous mass of separated or partially cellulosic fibres.

In order that the invention may be more readily understood, reference will now be made to a preferred embodiment of the invention illustrated in the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG 1 illustrates a flow chart of the method.

FIG 2 illustrates schematically an apparatus according to the invention.

DETAILED DESCRIPTION

In Fig 1, saw mill waste such as pine bark is granulated in a hammer mill 1 and is then graded into selected particle size ranges by passing through a series of graded screens 2. A suitable range of particle sizes may be between say 6 mm and 30 mm in 6 mm steps.

After grading into suitable particle size ranges the particle size ranges the particulate bark with attached sapwood is fed into a reaction vessel 3 containing an aqueous suspension of pulverised limestone or a mixture of pulverised limestone and dolomite. The particulate bark is maintained in the reaction vessel 3 with gentle agitation to allow neutralisation of at least the surface layer of the bark which is acidic due to the presence of tannins and the lignaceous material.

During the chemical treatment process one or more trace elements 4 may be added to the reaction vessel 3. The trace elements are selected according to the intended purpose of the peat moss alternative.

After a suitable reaction time in vessel 3, the chemically treated particles, impregnated with trace elements are fed into a container 5 of clean unheated water. As the hot bark particles start to cool, any sapwood and endogenous bark separates from the exogenous bark and settles to the bottom of container 5. This is believed to occur due to differentials in thermal expansion and water absorption between the sapwood and endogenous bark on the one hand and exogenous bark on the other.

The floating treated exogenous bark particles are then collected and subjected to initial drainage before being dried in a rotary kiln and after drying, the particulate bark is hermetically sealed in plastic bags or the like to prevent ingress of contaminants, particularly of the bacterial or fungal kind. This particulate product is used as a plant growth medium, particularly orchids as described in Australian Patent No. 634573.

The product according to this part of the process comprises a graded particulate exogenous bark product which is substantially pH neutral at least on the surface layer of the particles and is packaged in a clean sterile form. If required the product may be impregnated with trace elements or other plant nutrients.

This invention however concerns the further treatment of the sapwood, endogenous bark and the unspent limestone/dolomite mixture previously treated as a waste product from the process of Australian Patent No. 634573.

It has now been found, surprisingly, that if the sapwood and endogenous bark particles, having a relatively high moisture content of between 20 - 50% or higher, are then subjected to a milling action to coarsely shred the particulate matter, a coarse fibrous material is obtained with an appearance not dissimilar to coconut fibre or relatively dry peat moss or a mixture thereof.

Accordingly, as shown in FIG 1 after collection of the sapwood, a proportion of exogenous bark which sinks to the bottom of container 5 during processing, endogenous bark and the majority of the undissolved limestone/dolomite from container 5, this material is drained on a mesh conveyor belt 6 through which a current of dry heated air may be passed to reduce the moisture content of the sapwood/endogenous bark mixture.

When the particulate mixture is dried to a moisture content of between about 20% - 40% by weight, the particulate mixture is then fed into a shredder 7.

During the shredding action a coarse fibrous material is produced by separation of the cellulosic fibres rather than by a cutting or pulverising action which would otherwise occur with dry untreated material.

The shredding action to produce the fibrous mass is believed to arise from at least a partial removal of lignaceous matter which serves to bond the cellulose fibres together and swelling and softening of the cellulosic fibres due to the high moisture content.

Fig 2 illustrates one embodiment of an apparatus for substantially continuous production of peat moss alternative.

Graded pulverised bark mill waste is fed via hopper 10 onto a conveyor belt 11 for transfer to reaction vessel 12 at a predetermined feed rate. Feed rate may be controlled or varied by any suitable means such as a rotary feeder 13 on hopper 10 or adjusting the speed of conveyor 11 or both.

A further hopper 14 contains a mixture of pulverised limestone and magnesium silicate and this powdered material is metered onto the conveyor belt 11 by means of a vibratory feeder 15.

Reaction vessel 12 is substantially filled with water which is maintained at or near 100°C by a fuel fed boiler (not shown).

As the particulate bark is added to the reaction vessel it floats on the surface of the aqueous limestone suspension within the tank. The floating layer of bark is conveyed from one end of the vessel to the other at a predetermined rate by a walking beam conveyor 23 which momentarily elevates a layer of bark above the water surface as the layer progresses forwardly towards the outlet end of the vessel 12. Conveyor 23 comprises a plurality of rotating cranks 24 connected via link arms 25 to a bed 26 in the form of a wire mesh rack, timber platform or the like.

The oscillatory motion of the walking beam conveyor 23 not only serves to control the duration of treatment of the bark in reaction vessel 12, it also serves to continuously agitate the bark particles to ensure complete and even chemical treatment.

Located in the base of vessel 12 is a chain scraper 17 comprising spaced slats 18 extending between chain and sprocket drives 16 on each side of vessel 12. As the bark particles progress along the surface of the water in vessel 12, particles of sapwood, exogenous bark,

endogenous bark, dirt and other contaminants sink to the floor of vessel 12. The reaction product of the limestone, the lignaceous material and the soluble acidic components of the bark settles to the floor of vessel 12 as a viscous red-brown liquid containing at least some unreacted limestone.

Reaction time in the reaction vessel is dependent upon surface area of the bark particles. For finer grades having an average particle size around 6mm, a residence time of about 10 minutes is sufficient to neutralise the acidic bark residues, impregnate with trace elements and to sterilise the particles. For larger particles sizes of say, 30 mm, a residence time of up to one hour may be required to fully treat the bark.

The combined effects of walking beam conveyor 23 and chain scraper 17 transfer the treated bark particles and the reaction vessel residues, under the influence of gravity, to a separation vessel 19 containing clean, unheated water at ambient temperature. As the hot treated bark particles come into contact with the cold water the exogenous bark portion separates from the sap wood and endogenous bark portions and the latter sink to the floor of vessel 19 while the exogenous bark portion continues to float.

A perforated belt conveyor 20 removes from one end of vessel 19 the exogenous bark particles, impregnated with one or more selected trace elements or other plant nutrient media, while sedimentary residues are removed by a chain scraper 21 or the like.

The sapwood and endogenous bark particles are then subjected to partial moisture removal on a mesh conveyor 30 which allows excess liquid to drain away. Dry heated air is passed upwardly through the layer of particulate matter on conveyor 30 to reduce its moisture content to between about 25% - 35%.

The moisture reduced particles are then passed to a shredder 31 such as a Brentwood (TM) AZ-7 or AZ-15 or to

a modified hammer mill with spaced rows of enlarged apertures in the screen.

After shredding, the fibrous mass so produced is introduced into a rotary screen dryer 31 or the like to reduce the moisture content of the fibrous mass to between 10% - 20% for transportation efficiency.

The partially dried fibrous mass is then compressed and bagged for transport in sealed plastic bags to maintain moisture and sterility in the product.

The fibrous mass produced according to the process has an appearance not dissimilar to a mixture of coconut fibre and peat moss.

The peat moss alternative produced in accordance with the invention possesses most of the advantage of natural peat moss without the main disadvantages.

The peat moss alternative is sterile and otherwise free from plant pathogens, it is pH neutral and optionally may contain trace elements or other plant nutrients, herbicides, pesticides or fungicides which may be impregnated in the material during the chemical treatment process or added at some subsequent stage in processing.

A typical analysis of the peat moss alternative is as follows:-

Air filled porosity	17%
Water holding capacity	up to 80%
pH	6-7
Conductivity	0.06 ds/m
Chloride	35 mg/L
Ammonium Nitrogen	1 mg/L
Nitrate Nitrogen	3 mg/L
Total Nitrogen	4 mg/L
Sulphur	2 mg/L
Phosphorous	1 mg/L
Potassium	21 mg/L
Calcium	30 mg/L
Sodium	20 mg/L

Magnesium	25 mg/L
Ca/Mg Ratio	1:1.2
Potassium/Magnesium Ratio	0.84:1
Iron	21 mg/L
Manganese	2 mg/L
Copper	0.08 mg/L
Zinc	1 mg/L
Boron	0.21 mg/L
Aluminium	22 mg/L

It will be readily apparent to a skilled addressee that many modifications and variations may be made to the invention without departing from the spirit and scope thereof.

CLAIMS

1. A method for the manufacture of a peat moss alternative, said method comprising the steps of:-

treating granules of tree or plant bark at an elevated temperature in the presence of an aqueous alkali solution to kill heat labile plant pathogens and to at least partially dissolve lignins contained in said bark;

immersing said bark granules while heated into water at ambient temperature to cause separation of exogenous and endogenous portions of said bark granules;

collecting said endogenous bark portions; and,

milling said endogenous bark portions to cause at least partial separation of the cellulosic fibres therein.

2. A method according to claim 1 wherein said bark granules have a particle size in the range 5 mm to 50 mm.

3. A method as claimed in claim 1 or claim 2 wherein the pH of said aqueous alkaline solution is chosen to produce an endogenous particulate bark material having a substantially neutral pH.

4. A method as claimed in any preceding claim wherein the aqueous alkaline solution is selected from sodium or potassium chloride or hypochlorite, quicklime, soda ash, powdered limestone, slaked lime, dolomite or mixtures thereof.

5. A method as claimed in claim 4 wherein the alkaline solution comprises a mixture of powdered limestone and dolomite at least partially dissolved in water.

6. A method as claimed in any preceding claim wherein the alkaline solution also includes trace elements, plant nutrients, fungicides, pesticides and the like, either alone or in a preselected combination.

7. A method as claimed in any preceding claim wherein heat treating of the bark is achieved by any suitable means such as a hot air oven, steam oven, radiant heaters or microwave radiation.

8. A method as claimed in claim 7 wherein heat

treating is effected by heating the bark granules in a body of water at an elevated temperature at atmospheric or at elevated pressure in a pressure vessel.

9. A method as claimed in claim 8 wherein the bark granules are treated at a temperature in the range 50°C - 130°C.

10. A method as claimed in claim 9 wherein the bark granules are treated at a temperature between 95°C - 105°C.

11. An apparatus for the manufacturing of a peat moss alternative in accordance with any one of claims 1 to 10, said apparatus comprising:-

a heat treatment vessel including means to heat a body of liquid contained in the vessel;

conveyor means adapted to move bark particles through said heat treatment vessel at a predetermined rate;

a separation vessel containing, in use, a body of unheated water;

transfer means to transfer treated particulate bark from said heat treatment vessel to said separation vessel;

collection means to collect particles of treated exogenous bark from said separation vessel;

collection means to collect particles of treated endogenous bark from said separation vessel; and,

milling means adapted to shred particles of treated endogenous bark collected from said separation vessel to produce a fibrous mass of separated or partially cellulosic fibres.

12. An apparatus as claimed in claim 11 wherein said milling means comprise a shredder.

13. An apparatus as claimed in claim 11 wherein said milling means comprises a modified hammer mill.

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FIG.1

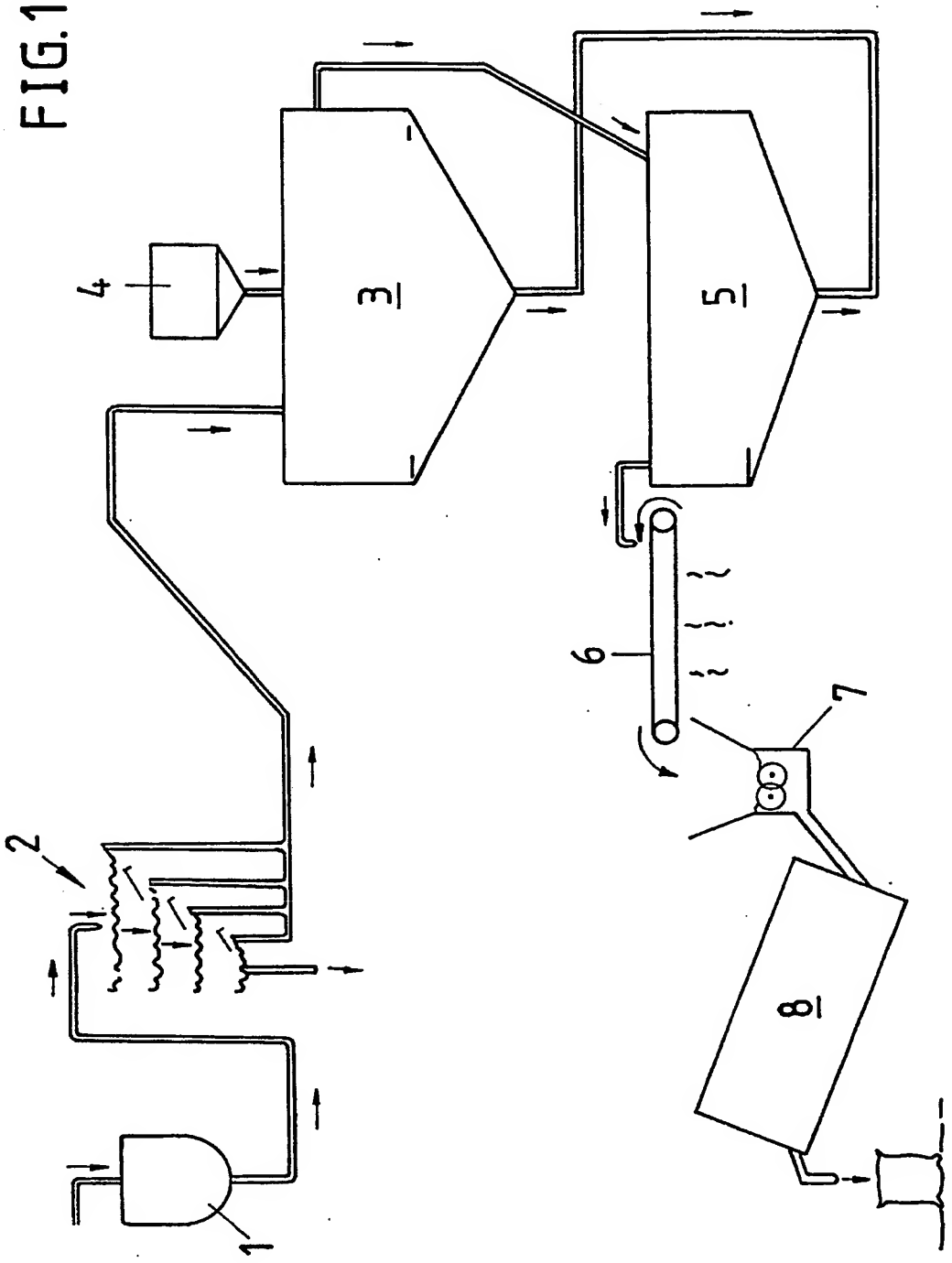

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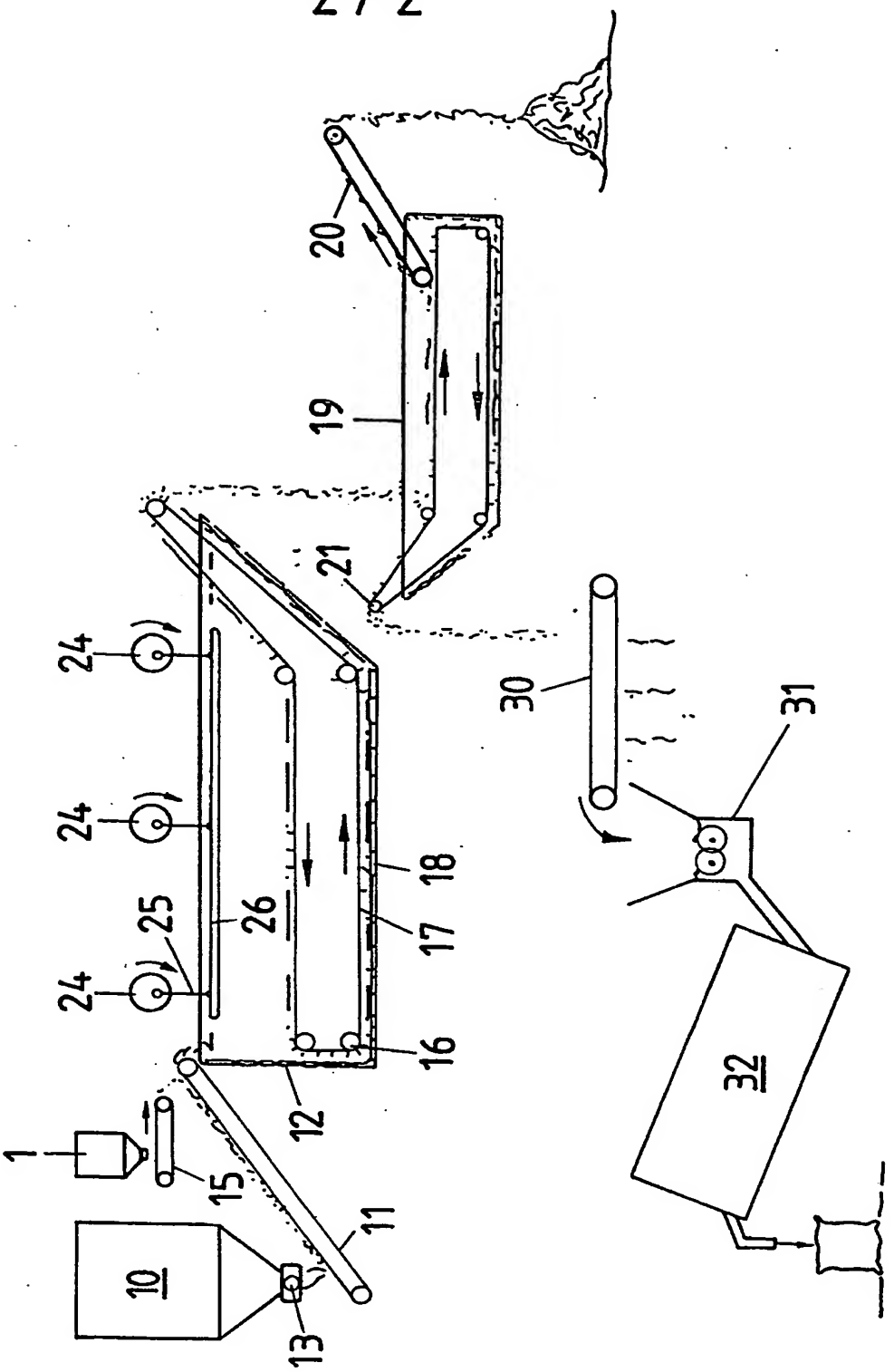
FIG. 2



INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU 94/00407

A. CLASSIFICATION OF SUBJECT MATTER
Int. Cl.[6] C09K 17/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC C09K 17/00

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
AU : IPC as above

Electronic data base consulted during the international search (name of data base, and where practicable, search terms used)
DERWENT : BARK OR PEATMOSS
JAPIO : BARK OR PEATMOSS

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to Claim No.
X	AU,B, 61832/90 (634573) (POLYWOOD PTY LTD) 7 March 1991 (07.03.91) entire document	1-13
A	CA,A, 1203991 (SOCIETE FRANCAISE d'A) 6 May 1986 (06.05.86) entire document	1,11
A	Derwent Abstract Accession No 93623/16, Class C03, DE,A, 3334540 (EBS HOLZKRAFT GMBH) 11 April 1985 (11.04.85) abstract	1,11

(continued)

[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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3 Nov 1994 (3.11.94)

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate of the relevant passages	Relevant to Claim No.
A	Derwent Abstract Accession No 92996/13, Class P63, EP,A, 360447 (CAMLAND PROD LTD) 28 March 1990 (28.03.90) abstract	1,11
A	Derwent Abstract Accession No 46109E/23, Class C03, D16, DE,A, 3040040 (HUMINAL VERTRIEBSGE) 23 October 1980 (23.10.80) abstract	1,11
A	AU,B, 50101/90 (619083) (DEBCO PTY LTD) 30 August 1990 (30.08.90) claim 1	1,11
A	Derwent Abstract Accession No 118773/16, Class A97, C04, A25, JP,A, 2-067392 (MATSUI KASEI KK) 7 March 1990 (07.03.90) abstract	1,11

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member					
AU	61832/90	WO	9102778				
CA	1203991	BE	893930	FR	2510593		
DE	3334540	NIL					
EP	360447	DK	4582/89	GB	8821976	NO	893710
DE	3040040	NIL					
AU	50101/90	NZ	232668	US	5192354		
JP	2-067392	NIL					
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